

Appl. No. 10/082,616
Reply to Office Action of October 6, 2003

Docket No. MIT-106PUS

REMARKS

Applicant respectfully requests reconsideration of the present application in view of the amendments set forth above and the below remarks.

Claims 1-66 are pending in the application: claims 24, 25, 31, 35, 36, 48, 49, and 53 are objected to and indicated to contain patentable subject matter; claims 1-10, 14-23, 26-30, 32, 33, 37-43, 45-47, 50-52 and 54-61 are rejected; and claims 11-13, 34, 44, and 62-66 are herein canceled without prejudice due to a restriction requirement.

The Claim Objections

The Examiner objects to claims 4 and 5 on the basis that the word "former" is unclear. Applicant submits that a former is equivalent to a bobbin as indicated in the enclosed representative Web printout for a global provider of transformer products. Applicant submits that the term "former" is well known to one of ordinary skill in the art so that the objection should be withdrawn.

The Prior Art Rejections

The Examiner rejects claims 1, 3-5, 27, 33, 38 and 40 under 35 U.S.C. §102(b) over U.S. Patent No. 4,577,145 to Mullersman.

Applicant submits that the invention of claim 1 is readily distinguishable over Mullersman. Mullersman is directed to a charging system that includes a resonant tank circuit. As noted by the Examiner, the capacitive and inductive reactances cancel at resonance to provide a resistive impedance characteristic in accordance with well-known properties of resonant circuits.

Applicant submits that Mullersman is not relevant to the claimed invention, which is directed to canceling the *inductance* (associated with stored magnetic energy) of a *capacitor*. As set forth in detail in the present specification, the capacitance provided by capacitors in circuits, such as a filter, is desired. However, the parasitic inductance associated with capacitors at certain frequencies is typically quite undesirable. The present invention provides a circuit to

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cancel the parasitic inductance of capacitors using coupled windings. The present invention achieves a different physical effect than the system of Mullersman, and does not accomplish it using resonance as in Mullersman.

Accordingly, Applicant submits that claim 1 is clearly patentably distinguishable over Mullersman. For substantially the same reasons, Applicant submits that claims 2-10, 14-33, 35-43, and 45-61 are also distinguishable over Mullersman.

With regard to claim 27, Applicant respectfully requests clarification with regard to the Examiner's assertions regarding the claim preamble. Applicant submits there is no requirement for the preamble to "breathe life and meaning" into the claim and the claim contains subject matter that is patentably distinguishable over Mullersman.

Claims 1, 2, 4, 14-16, 27, 32, 38, 39, and 45 are rejected under §102(b) over U.S. Patent No. 5,495,405 to Fujimura et al.

Applicant submits that Fujimura, like Mullersman, is directed to features associated with resonant circuits that are not relevant to the present invention. Fujimura discloses a circuit that uses a parasitic capacitance as a component of a resonant circuit. Fujimura does not teach or suggest the cancellation of inductance associated with a capacitor as required by the claimed invention.

Accordingly, Applicant submits that claims 1, 2, 4, 14-16, 27, 32, 38, 39, and 45 are patentably distinguishable over Fujimura taken alone or in combination with other references of record.

The Examiner rejects claims 1, 3, 9, 10, 14-23, 26-30, 33, 37, 38, 40, 42, 43, 45-47, 54 and 55 under §102(e) over U.S. Patent No. 6,476,689 to Uchida et al.

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Claim 1 requires an electrical component including a capacitor having first and second ends and a circuit coupled to the capacitor, the circuit including magnetically-coupled windings for providing capacitor-path inductance cancellation. With this arrangement, a filter, for example, that includes a capacitor having a desired capacitance value to achieve particular filter characteristics has enhanced performance over a relatively wide frequency range due to cancellation of parasitic inductance associated with the capacitor.

In contrast, Uchida is directed to a circuit to overcome the "problems" set forth beginning at column 1, line 64 (emphasis added):

"Among the conventional inductors suitable for large currents, there is an inductor formed by winding coated copper wiring around a ferrite ring core. To construct an LC filter using such an inductor, it is necessary to *separately install a capacitor*. This increases the number of components, and further a stray capacitance and a *residual inductance* are generated because the inductor and the capacitor are connected by connecting *separate components*, resulting in *insufficient attenuation characteristics*."

As described by Uchida, the circuit *eliminates a capacitor component* in an LC filter by providing a capacitor electrode in opposition to two inductively coils as explained beginning at column 2, line 20 (emphasis added):

"The laminated LC noise filter in accordance with a first preferred embodiment of the present invention includes a magnetic body and two coils disposed in the magnetic body, which are defined by a metallic plate having a spiral shape, and which are connected in series to generate a mutual inductance therebetween. A *capacitor electrode plate*, having a shape which is included within the shape range of the coils when viewed from the axial direction thereof such that it does not interfere with the magnetic flux generated by the coils, is disposed in the vicinity of the connection point of the two coils in the magnetic body such that at *least a portion of the capacitor electrode plate is opposed to a portion of the coils*.

By arranging the two spiral shaped coils to be serially connected to generate a mutual inductance, and disposing the capacitor electrode plate, in the vicinity of the connection point of the two coils so as to be opposed to a portion of the coils, the *coils also act as a capacitor electrode*. This *reduces the number of components*, and eliminates the need to provide a capacitor independently of the coils, resulting in *greatly reduced residual inductance*.

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Thus, Uchida does not disclose a discrete capacitor having first and second *ends* as claimed. Applicant submits that the coils acting as a capacitor electrode provide a *distributed* circuit that cannot be considered an *end* of a capacitor, as required by the claimed invention.

Further, Uchida refers to a "residual inductance" that is associated with the interconnection of components. That is, connections between components have parasitic impedances that can degrade circuit performance and Uchida focuses on eliminating a capacitor component to reduce the "residual inductance" associated with connecting a capacitor. As explained by Uchida at column 6, lines 21-27,

"since the capacitor is defined by the coils L1 and L2 and the capacitor electrode plate 10, a capacitor does not need to be separately connected, unlike the case where an LC filter is formed of an individual inductor and capacitor. Thus, a significant reduction in the residual inductance due to the connection of the coils L1 and L2 and a capacitor is achieved."

Uchida further explains that

"[T]he equivalent circuit of the LC filter of the above-described first preferred embodiment is illustrated in FIG. 4. Since the mutual inductance M between the coils L1 and L2 is positive, a negative inductance (-M) exists between the node of the coils L1 and L2 and the ground. This inductance (-M), a residual inductance (ESL: Equivalent Series Inductance), and a capacitance (C), therefore, define a series circuit in this equivalent circuit of the LC filter of the first preferred embodiment.

In the circuit where a residual inductance and a capacitor are connected in series, series resonance occurs, and at the resonance point, attenuation grows, but beyond the resonance point, the attenuation decreases due to an increase in impedance.

However, since the LC filter of the first preferred embodiment is constructed so that a negative inductance (-M) is connected in series, the residual inductance (ESL) is canceled by adjusting the degree of coupling between the two coils so that the negative inductance (-M) equals the residual inductance (ESL) in the equivalent circuit. This enables the formation of an LC filter capable of having an attenuation effect up to a high frequency range by suppressing the occurrence of series resonance."

Uchida does not recognize or address canceling the *inductance of a capacitor* as claimed, but rather focuses on reducing interconnection *residual inductance* by eliminating a capacitor component and suppressing series resonance.

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The Examiner points to Figure 4 of Uchida as showing the claimed electrical component. Applicant respectfully points out that the circuit of Figure 4 is a model. It does not show the physical system proposed by Uchida, and it is not possible to build the circuit as shown. As described by Uchida in the Brief Description of the Drawings section, "FIG. 4 is a diagram showing the equivalent circuit of the LC filter." Moreover, the components in circuit models do not have parasitic impedances; rather they provide ideal characteristics that are used to model the behavior of some physical system. Uchida's model accounts for *interconnect residual inductance* for component connections but does not teach or suggest canceling the inductance (associated with stored magnetic energy) of a physical capacitor. Uchida attempts to achieve high-frequency attenuation by using a structure that "eliminates the need to provide a capacitor independently of the coils, resulting in greatly reduced residual inductance."

Accordingly, Applicant submits that claim 1 is patentably distinguishable over Uchida. For substantially the same reasons, Applicant submits that claims 3, 9, 10, 14-23, 26-30, 33, 37, 38, 40, 42, 43, 45-47, 54 and 55 are also distinguishable over Uchida.

Applicant further submits that certain dependent claims are patentably distinguishable over the cited references for additional reasons.

For example, claim 3 requires that the electrical component of claim 1 have the coupled windings integrated with the capacitor. As described in the specification, in an exemplary embodiment, "coupled magnetic windings are combined with a capacitor to form an integrated filter element having inductance cancellation in accordance with the present invention. The integrated element can be provided as a single three-terminal device..." FIGs. 4D, 14 and 15C show exemplary embodiments of possible integrated arrangements.

Applicant submits that such an arrangement is not possible for the circuits disclosed by Uchida since there is no discrete capacitor. For example, the windings cannot be formed around a capacitor in Uchida's circuit, as taught by Applicant in an exemplary embodiment.

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Claims 6-8, 10, 41 and 43 are rejected under 35 U.S.C. §103 over Mullersman in view of U.S. Patent No. 6,529,363 to Waffenschmidt et al.

Applicant submits that Waffenschmidt fails to remedy any of the deficiencies of Mullersman described above. Waffenschmidt merely discloses a capacitor integrated into a transformer via a multi-layer foil winding of planar conductive electrodes alternating with insulating dielectric foil. Applicant submits that the foil winding of Waffenschmidt is quite different from the claimed windings formed from foil. An exemplary foil winding is shown in FIGs. 15A-C.

Applicant submits that claims 6-8, 10, 41, and 43 are patentably distinguishable over Mullersman and Waffenschmidt, taken alone or in combination with each other.

Claims 10 and 43 are rejected under §103 over Fujimura in view of U.S. Patent No. 6,239,557 to Chang et al.

Applicant submits that Chang does not overcome any of the shortcomings of Fujimura set forth above. Chang merely discloses a transformer winding technique with reduced parasitic capacitance effects.

Accordingly, Applicant submits that claims 10 and 43 are patentably distinguishable over Fujimura and Chang, taken alone or in combination with each other.

Claims 50-52, 56, and 57 are rejected under §103 over Uchida in view of Hamill.

Applicant submits that Hamill does not remedy any of the shortcomings of Uchida set forth above in detail. In addition, Applicant respectfully requests clarification as to the identity of the capacitively-coupled conductors in Hamill. In a thorough review of Hamill, Applicant was unable to locate any capacitively coupled conductors.

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Applicant submits that claims 50-52, 56 and 57 are patentably distinguishable over Uchida and Hamill, taken alone or in combination with each other.

Claims 58 and 59 are rejected under §103 over Uchida in view of Hamill and further in view of U.S. Patent No. 5,694,297 to Smith et al.

Applicant submits that Smith does not provide any of the missing teachings described above for Uchida and/or Hamill. Smith merely discloses an integrated circuit mounting structure including a switching power supply formed on printed circuit board.

Applicant submits that claims 58 and 59 are patentably distinguishable over Uchida, Hamill, and Smith, taken alone or in combination with each other.

Claims 60 and 61 are rejected under §103 over Uchida in view of Hamill and further in view of Waffenschmidt. For at least the reasons discussed above, Applicant submits that Uchida, Hamill and Waffenschmidt, alone or in combination with each other, fail to teach or suggest the claimed invention.

With regard to the Examiner's assertion that the term "printing process" is not given patentable weight, Applicant does not agree. It is Applicant's position that the structure of the invention is readily ascertainable from the claim language by one of ordinary skill in the art in accordance with the standards clearly set forth by the court. Notwithstanding the above, Applicant amends claim 60 without prejudice to clarify the structure of the claimed circuit.

In view of the above, Applicant submits that claims 1-10, 14-33, 35-43, and 45-61, are in condition for allowance for which a notice thereof is respectfully requested.

The Examiner is respectfully invited to telephone the undersigning attorney if there are any questions regarding this Amendment or this application.

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Applicant does not acquiesce to any assertion made by the Examiner not specifically addressed herein.

The Assistant Commissioner is hereby authorized to charge payment of any additional fees associated with this communication or credit any overpayment to Deposit Account No. 500845.

Respectfully submitted,

Dated: 6. Feb 04

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About Transformer Winding Services

Transformer winding services providers design transformers and other magnetics products for application-specific and OEM usage in a variety of industrial, medical, military, aerospace, telecommunications, commercial and specialty applications. Frequently, transformer design is best accomplished through consultative development with a custom transformer services manufacturer, who can assist and advise on design optimization and cost options. The suppliers represented in this search form can produce customer-specified designs and quantities for many types of applications and environments.

In general, electrical transformers are used to step-up the generator voltage for transmission, or to step-down the transmission voltage to intermediate levels of distribution. While transformer designs can vary greatly depending upon the application and power generation / output needs, almost all follow the same basic configuration. Transformers generally consist of one or more winding or coils, made of conducting wire, which is wound on a former or bobbin. The bobbin surrounds the central limb of the circuit, which is fabricated from magnetic material, and usually referred to as the core. Often there are multiple limbs in the transformer design. The winding wires are insulated and the core is made from thin sheet steel plates known as laminations. The laminations serve to reduce the losses incurred due to eddy current resistance. Clamps hold the entire assembly together, and these clamps are held in place by long screws that are insulated from the rest of the structure. The winding wires are either attached to terminals mounted on the clamps or they may leave the coil by flying leads.

Some of the more common transformer styles that may be fabricated by custom transformer services providers include autotransformers, buck boost transformers, control transformers, current transformers, distribution transformers, ferrereonant transformers, filament transformers, flyback transformers, high frequency transformers, isolation transformers, laminated transformers, power transformers, pulse transformer, radio frequency (RF) transformers, step-up and step-down transformers, switchmode transformers, three phase transformers, and toroidal transformers. In addition to the listed types, custom transformer services providers can also create specialized or proprietary transformers per customer needs.

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